

# APPROVAL SHEET FOR SUSPENDED LOAD OPERATIONS

SLO-KSC- 1997 - 003

TITLE Installation of SpaceLab Transfer Tunnel using the Strongback at OPF

DOCUMENT NUMBER/TITLE OM165006 Transcan/Horizontal Cargo Installation/Removal

PREPARED BY G. D. O'Neil A91, F674

DATE \_\_\_\_\_

## REQUIRED APPROVAL

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| M. Glenn           | <i>M. Glenn</i>        | EI-C-A                                  | 4/15/97 |
| R. Gillett         | <i>R. Gillett</i>      | EI-F                                    | 4/14/97 |
| D. Frank           | <i>Daryl S. Frank</i>  | EI-C                                    | 4/15/97 |
| R. J. Quigg III    | <i>R. J. Quigg III</i> | A91-F272                                | 4/14/97 |
| W. Dankovchik      | <i>W. Dankovchik</i>   | A91-F670                                | 4/14/97 |
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CONTRACTOR DIRECTOR OF SAFETY

**NASA SUSPENDED LOAD OPERATION  
ANALYSIS/APPROVAL**

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**OPERATIONS**

To install the keel trunnion and associated hardware for the SpaceLab Transfer Tunnel (STT) prior to inserting the tunnel into the orbiter in the OPF.

**SUPPORTING DOCUMENTS** - The associated operational procedures and System Assurance Analysis (SAA) are as follows:

- OMI E5006, Transcan/Horizontal Cargo Installation/Removal
- SAA09FY091-001, 30 Ton Bridge Cranes- OPF (Bays 1 and 2)
- SAA09FY091-007, 30 Ton Bridge Cranes- OPF (Bay 3)

**GENERAL DESCRIPTION**

Installation of the STT from the tunnel dolly/workstand requires a maximum of three persons under the suspended STT and Strongback fixture to install the keel trunnion and associated hardware.

These tasks require personnel to be in the area of increased hazard directly under the suspended STT and the Strongback fixture. OMI E5006 is the controlling procedure which is used in the OPF processing bays.

During contingency payload grounding operations, one person will be permitted to work under the suspended load.

**RATIONALE/ANALYSIS** - The suspended load tasks comply with the NASA Alternate Safety Standard as follows:

**Alternate Standard Requirement #1a** - These tasks cannot be conducted without placing personnel beneath the suspended STT and the Strongback fixture because there is no other access to the hardware attach points.

During all of these operations, the load must be hoisted above its appropriate holding fixture to provide access for hardware installation. As a result, there are no operational or procedural means to eliminate personnel exposure to the suspended load because of lack of access to the attach points.

The design of additional support structures for the load is not feasible because access to the attach points would be blocked.

**Alternate Standard Requirement #1b** - The possible use of a secondary support system, to catch the load in the event of a crane failure, was analyzed. It was determined that the use of a secondary support system was not feasible because of positioning of the STT over the tunnel dolly/workstand.

**Alternate Standard Requirement #1c** - The maximum number of personnel allowed under the suspended STT and Strongback fixture during removal or installation of the keel trunnion and associated hardware is three.

**Alternate Standard Requirement #1d** - The operation will be accomplished as quickly and safely as possible to minimize exposure time. It will take three technicians 1.0 hour to install the keel trunnion and the associated hardware.

**Alternate Standard Requirement #4** - OMI E5006 has been revised to permit only the approved number of persons under any of the combinations of suspended loads covered in this report. The OMI is available on site for inspection during the operation.

**Alternate Standard Requirement #6** - The suspended load operations covered by this report are conducted in the OPF and involve two 30 ton bridge cranes. The cranes are designed, tested, inspected, maintained, and operated in accordance with the NASA Safety Standard for Lifting Devices and Equipment, NSS/GO-1740.9.

The OPF (Bays 1 and 2) 30 ton crane hoists are equipped with a gear reducer and mechanical load brake enclosed in one unit, an electric drive motor, a motor brake at the south end of the drum, and a solenoid-actuated band brake at the north end of the drum. The OPF (Bay 3) 30 ton crane hoists are equipped with two electrical holding brakes at each end of the drum. All brake's are capable of holding the load up to their respective crane's rated capacity. Each brake's ability to hold the rated load (30 tons) is verified annually. The cranes are designed to meet a 5 to 1 safety factor based on ultimate strength for the hoist load bearing components.

Two 30 ton cranes are being utilized for this task. The weight of the load (including the Strongback) is a maximum of 31,500 lbs, which is 26.3% of each crane's capacity.



The Strongback is rated to hoist 65,000 lbs and is designed to the American Institute of Steel Construction standards.

The 30 ton cranes are load tested annually at 100% of their rated capacity. Detailed preventive maintenance is performed monthly, quarterly, semiannually, and annually on the cranes to ensure proper operation. Nondestructive testing of the crane hooks is performed annually.

**Alternate Standard Requirement #7** - A System Assurance Analysis (SAA) has been completed on the 30 ton bridge cranes in the OPF. The SAA includes a Failure Modes And Effects Analysis/ Critical Items List (FMEA/CIL) and a hazard analysis (see supporting documents). ). SAAs for the thirty ton bridge cranes in OPFs (Bays 1,2,&3) indicate no Single Failure Points.

**Alternate Standard Requirement #8** - Visual inspections for cracks or other signs of damage or anomalies are performed on the hoist hooks, hoist beams, hoist cables, hoist rod assemblies, and hoist fittings, and crane functional checks are performed before each operation per NSS/GO-1740.9.

**Alternate Standard Requirement #9** - Trained and licensed crane operators shall remain at the hoist controls while personnel are under the load.

**Alternate Standard Requirement #10** - Appropriate safety control areas are established before initiating operations. Only the minimum number of people (manloaded in the procedure) will be permitted in this area.

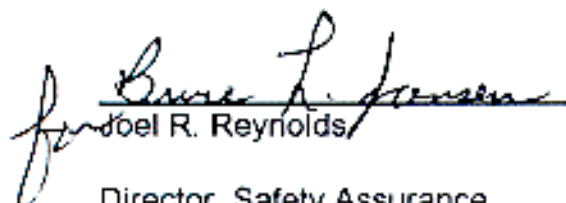
**Alternate Standard Requirement #11** - A pretask briefing and a safety walkdown of the area are conducted prior to the lift to ensure that all systems and personnel are ready to support. All participants are instructed on their specific tasks and warned of any hazards involved. Following any crew change, the new personnel are instructed by the task leader on their specific tasks and warned of any hazards involved.

**Alternate Standard Requirement #12** - Personnel beneath the suspended load will be in voice contact with the hoist operator and/or task leader. Upon loss of communication, the operation shall stop immediately, personnel shall clear the hazardous area, and the load shall be safed. Operations shall not continue until communications are restored.

**Alternate Standard Requirement #13** - Personnel working beneath the load shall be in continuous sight of the hoist operator and/or task leader.

APPROVAL:

DATE:

 4/15/97  
for Bruce L. Jensen  
Joel R. Reynolds

Director, Safety Assurance  
Kennedy Space Center